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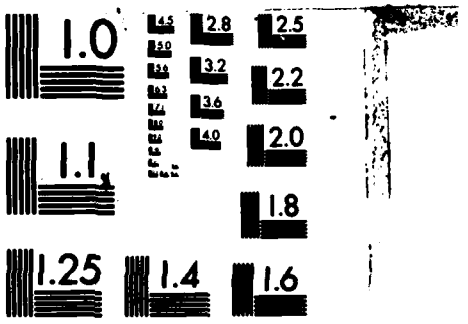

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TECHNICAL REPORT

AD-A140 807

ABSTRACTS OF RESEARCH PROJECT REPORTS BY NAVAL DENTAL CLINIC FIRST- AND SECOND-YEAR RESIDENTS - JUNE 1983

by

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and
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NAVAL MEDICAL COMMAND
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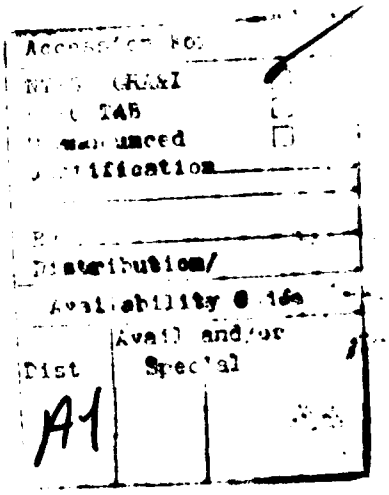
ABSTRACTS

These abstracts provide a synopsis of research projects currently under investigation or completed by dental officers enrolled in the first- and second-year residency programs at the Naval Dental Clinic, Bethesda, Maryland, during the academic year 1982-1983. The projects were undertaken in partial fulfillment of the requirements of the training program.

The opinions and assertions contained in these abstracts are the private ones of the writers and are not to be construed as official or as reflecting the views of the Department of the Navy.

Studies involving human subjects were conducted with the approval of the Committee for the Protection of Human Subjects.

Studies involving animal subjects were conducted according to the principles set forth in the Guide for the care and use of laboratory animals, Institute of Laboratory Resources, National Research Council, DHEW, Pub. No. (NIH) 74-23.



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ABSTRACTS OF FIRST-YEAR REPORTS

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ABSTRACTS OF FIRST-YEAR REPORTS

No. 1
AN IN VITRO EVALUATION OF PERFLUOROCTYLBROMIDE AS AN ENDODONTIC IRRIGATING SOLUTION IN ENDODONTIC TREATMENT

J. D. Allemang

Perfluoroctylbromide (PFOB) is a highly fluorinated radiopaque compound with a high oxygen-carrying capacity. The purpose of this study was (1) to evaluate the antibacterial effect of the oxygen-carrying capability of PFOB on an anaerobic organism and (2) to determine whether PFOB can be combined with NaOCl in water to create an endodontic irrigating solution that will radiographically demonstrate canal configuration and maintain the antibacterial activity of NaOCl. We evaluated the antibacterial properties of PFOB by transferring 5 µl of pure PFOB or saline solution (control) to sterile 10-mm filter-paper disks located on the surface of sheep's blood agar plates previously inoculated with a suspension of Bacteroides melaninogenicus. A zone of inhibited bacterial growth around a disk after 48 hours of anaerobic incubation at 37° C was indicative of antibacterial activity. An experimental irrigating solution was prepared as an emulsion of PFOB and 2.63-percent NaOCl in water, with Pluronic F68 in Ringer's lactate as the emulsifying agent. Filter-paper disks were prepared with saline solution, 2.63-percent NaOCl, pure PFOB, or the test solution as previously described. We evaluated the radiopacity of the test solution by radiographing extracted teeth after irrigating the pulp chamber and canal system with the solution. Pure PFOB had no antibacterial effect on B. melaninogenicus; however, the experimental irrigating solution retained the antibacterial activity of NaOCl and the radiopacity of PFOB.

No. 2
CLINICAL EVALUATION OF HUMAN FREEZE-DRIED BONE ALLOGRAFTS IN CONJUNCTION WITH BIOLOGICALLY PREPARED ROOT SURFACES

D. A. Asaad

Repair and regeneration of the periodontal attachment apparatus has been a goal of periodontal surgery for years. Unfortunately, most treatment modalities do not achieve total regeneration of the periodontium. Recent studies have addressed root surface changes associated with periodontal disease. Various chemicals have been evaluated clinically for their effect on root surfaces, but most appear to be too harsh for use during surgical treatment. In one study, sodium deoxycholate was used to dissociate endotoxin, and human plasma fraction Cohn IV_1 was used to bind the endotoxin. This approach avoids extensive deep root planing or the use of harsh chemicals and appears to produce clinically effective results. Although several studies have evaluated the use of sodium deoxycholate and plasma fraction Cohn IV_1 for detoxifying root surfaces, no known human studies have been done to evaluate this root treatment in conjunction with freeze-dried bone allografts. The purpose of the present study was to evaluate the efficacy of freeze-dried bone allografts in combination with sodium deoxycholate and a human plasma fraction. The pooled human plasma fraction was tested for the presence of hepatitis-B viral antigen and antibodies. The fraction tested negative for antigen but positive for antibodies. Unfortunately, no test is available for non-A non-B hepatitis or for the presumedly infectious disease acquired immunodeficiency syndrome (AIDS). Because the plasma fraction

was pooled from more than 1,000 donors, it was decided that the risk of transmitting potentially infectious agents outweighed the potential benefit to the patient. The project cannot be completed with pooled plasma, but efforts will be directed toward looking for a suitable substitute.

No. 3

AN IN VITRO COMPARISON OF THE THERMAL EFFECTS OF A VISIBLE-LIGHT-CURED RESIN SYSTEM WITH A CHEMICALLY CURED RESIN

G. E. Bennett

The purpose of this in vitro study was to compare the heat produced in the pulp chamber of the tooth by visible-light- and chemically cured composite resins. Thirty extracted human maxillary anterior teeth were divided into three groups of 10. Teeth in group 1 (control) were restored with a chemically cured resin (Concise), and those in groups 2 and 3 with a visible-light-cured resin (Prisma-Fil). The resin in group 2 was cured with the Midwest In Sight II light generator, the resin in group 3 with the Prismalite. A standardized cavity preparation was made in the buccal or labial surface of each tooth. Then an access preparation was made in the lingual surface to place a thermistor in the pulp chamber. A layer of dentin 1.6-1.7 mm thick was maintained between the floor of the cavity preparation and the access preparation, and the tooth was restored with the selected resin. The thermistor was connected to an electronic digital thermometer and a strip-chart recorder. Both curing methods increased the temperature in the pulp chamber above the baseline (ambient room temperature), with the visible-light method producing the greater increase. The temperatures produced by the curing methods differed from one another significantly ($P < .001$ by a one-way analysis of variance and Scheffe's test). The mean temperature increase produced in the pulp chamber by the chemically cured resin (control) was $0.41° \pm 0.09°$ C above baseline. For the Prismalite, it was $1.84° \pm 0.31°$ C, and for the In Sight II, it was $3.81° \pm 0.67°$ C. Temperature increases of this magnitude have caused pulpal stigmata in monkeys.

No. 4

A STUDY ON THE EFFECT OF A DUAL WAXING TECHNIQUE FOR CASTING FIT OF SINGLE UNIT CASTINGS

K. G. Biedermann

Since the lost wax technique was devised for use in dental restorations, investigators have attempted to achieve a closer fit for final castings. For this reason, both the wax pattern component and the investment technique have come under close scrutiny. Castings fabricated with a dual wax technique are reported to give a better fit, but there are no studies that verify this quantitatively. The purpose of this study was to make a quantitative comparison of the single wax and dual wax techniques for casting adaptation. Of 40 castings used in the study, 20 were fabricated with single blue Type II inlay wax and 20 with one-third Type II inlay wax and two-thirds green casting wax. A specially designed steel die system was used to produce consistent and annealed patterns. A measuring microscope was used to determine the seating distances of the castings. The difference between mean and standard deviation seating fits of 0.49 ± 0.19 mm (Type II inlay) and 0.49 ± 0.13 mm (two-thirds soft, one-third Type II) were not statistically significant ($P > .05$ by Student t test). These findings indicate that either wax composition method will give the same fit to a casting.

No. 5

AN EVALUATION OF THE DYNATRAK™ SYSTEM VS. CONVENTIONAL AND GIROMATIC TECHNIQUES FOR INSTRUMENTING CURVED ROOT CANALS

B. B. Burkett

Problems commonly encountered during the enlargement of curved root canals include stripping, zipping, ledging, and canal perforation. The special design featured in the Dynatrak system is reported to increase flexibility, thus allowing instrumentation to follow the natural contour of the canal. The purpose of this study was to compare the Dynatrak system with conventional (control) and Giromatic techniques for efficacy of instrumenting curved root canals in extracted human mandibular molars. Canals were instrumented in 15 molars with mesial canals that were moderately curved according to the curvature classification system of Schneider. Ten canals were instrumented by each instrumentation method. The prepared canals were filled with rubber base impression material to provide a contrast medium and then were evaluated by one investigator in a blind manner for stripping, zipping, ledging, canal perforation, and instrument separation. A process of decalcifying and clearing the teeth was undertaken to permit observation of the instrumented canals by stereo zoom microscopic examination. Preliminary results suggest that instrumentation errors produced by the Dynatrak and Giromatic techniques are comparable to those produced by the conventional methods. Sample sizes are being increased to validate these findings.

No. 6

A MICROLEAKAGE STUDY COMPARING ROUND AND SHARP OUTLINE FORMS OF CLASS V COMPACTED GOLD RESTORATIONS

J. L. Currier

No studies are available that demonstrate the microleakage of rounded cavosurface configurations of compacted gold restorations. The purpose of this study was to compare the marginal leakage, in enamel, of Class V compacted gold restorations placed in a classic trapezoidal outline, with sharp line angles and straight cavosurface margins, and the leakage of restorations placed in preparations with rounded cavosurface margins. Forty extracted human teeth were used, half prepared with the sharply angled cavosurface design and the other half with a rounded cavosurface design. The teeth were restored with compacted gold (Electraloy) and then thermocycled 500 times between 5° C and 55° C. The teeth were stained with silver nitrate and sectioned, and the restorations were removed. The preparations were evaluated for microleakage with a dissecting microscope. Of the 40 teeth studied, 38 showed some degree of microleakage. The teeth with the rounded cavosurface design showed significantly less microleakage than those with the traditional cavosurface design ($P < .01$ by chi-square analysis). The sharp angles of the traditional cavosurface design showed the deepest penetration of silver nitrate.

No. 7
EVALUATION OF A DUAL-STAGE, RINGLESS PARTIAL DENTURE INVESTMENT TECHNIQUE FOR USE IN FIXED PROSTHODONTICS

W. M. Dern

A two-stage ringless investment technique has long been used in the fabrication of RPD frameworks, in part to maximize the egress of trapped gases during casting. The effect of this technique on the castability of a base metal crown and bridge alloy (Ceramalloy II) was evaluated. Sixty standardized castability test patterns were cast on two different casting units at two different mold temperatures (1,250° F and 1,500° F). Thirty experimental patterns were painted with a shell of vacuum-mixed investment, allowed to initially set, and covered with a porous, hand-whipped investment mix. After final set, the ring and liner were removed. As a control, 30 patterns were invested with a standard, one-step technique with a ring and liner. Castability values (expressed as a percent) were determined from the number of completely cast grid segments surrounding the 100 squares in the polyester sieve cloth test patterns. No significant difference ($P > .05$) was found between the castability values of the standard technique and those of the two-stage ringless technique. Significant differences ($P < .01$) were found between the values obtained from the two different casting units. The two-stage ringless partial denture investment technique did not improve the castability of a base metal crown and bridge alloy. The obvious differences in results obtained from two different casting machines suggest a significant casting variable that warrants further investigation.

No. 8
DIMENSIONAL STABILITY OF AUTOPOLYMERIZING IMPRESSION TRAY RESINS

A. W. Fehling

Two autopolymerizing acrylic resins, Fastray (Bosworth) and Formatray (Kerr), were evaluated to determine the optimal time between fabrication of an impression tray and the making of the final impression. Identical mandibular arch trays, 10 of each resin, were made on a custom-ground aluminum master cast. Trays were measured for dimensional change every 20 minutes for 2 hours from the start of the resin mix and then at hours 3, 4, 5, 6, 24, and 72. Measurements for dimensional change were made across anterior buccal-to-buccal flanges, posterior buccal-to-buccal flanges, and posterior unilateral buccal-to-lingual flanges. Dimensional changes were greatest in the first 40 minutes and then decreased substantially. Dimensional changes were consistently similar in the 20 trays tested. Previous studies have reported shrinkage of autopolymerizing resin trays. Our study confirmed cross-arch flange shrinkage, but we also observed unilateral buccal-to-lingual flange expansion. Expansion between the buccal and lingual flanges resulted from resin shrinkage toward the greatest bulk of resin at the anterior handle area. This shrinkage was more pronounced in the lingual flange. For greatest accuracy in a master cast, 40 minutes should elapse between tray fabrication and impression making, and then the final impression should be poured up as soon as possible.

No. 9

A DETERMINATION OF CHANGES IN PLASMA CATECHOLAMINE CONCENTRATIONS ASSOCIATED WITH THE PLACEMENT OF RACEMIC-EPINEPHRINE-IMPREGNATED RETRACTION CORD IN THE GINGIVAL SULCUS

C. L. Hatch

Epinephrine is known to produce specific hemodynamic effects by stimulating the sympathetic nervous system. These effects are strongly dose related. A retraction cord that is in common use contains a significant concentration of racemic epinephrine that may be absorbed through the gingival sulcus. This absorbed epinephrine may cause a significant increase in plasma catecholamine concentrations. All previous studies were based on changes in vital signs instead of actual measurements of plasma catecholamines. The intent of this study is to determine whether epinephrine absorbed from the retraction cord through the gingival sulcus reaches concentrations significant enough to produce sympathetic stimulation. We approached this by evaluating heart rate (HR), mean arterial pressure (MAP), pulse pressure product (PPP), plasma epinephrine (E), and plasma norepinephrine (NE) responses to the placement of an 8-percent racemic-epinephrine- and alum-containing retraction cord. Twelve normotensive healthy adults (mean age 29 years) volunteered to participate in a randomized double-blind crossover study. A 1-inch length of 8-percent racemic-epinephrine retraction cord caused no significant changes in HR, MAP, or PPP when compared with the control cord, which did not contain epinephrine. The final results of this study will include findings of the catecholamine assay for plasma epinephrine and norepinephrine concentrations.

No. 10

A STUDY ON THE INCIDENCE AND DISTRIBUTION OF ATTACHED CEMENTICLES ON HUMAN TOOTH ROOT SURFACES

W. L. Holton

Cementicles, small bodies of calcified cementumlike substance that may adhere to the root surface, can be an important factor in the selection of the modality of periodontal therapy for involved teeth. Little information is available about where cementicles are usually found. This study was undertaken to determine the incidence and distribution of attached cementicles on different root surfaces of extracted teeth. The 415 teeth selected included maxillary and mandibular incisors, cuspids, bicuspids, and molars. The teeth were boiled in water and soaked in a 5.25-percent solution of sodium hypochlorite to clean the root surfaces of any soft tissue and debris. Examination with a dissecting microscope showed cementicles on 144 (34 percent) of the teeth. Cementicles were seen on approximately 50 percent of the cuspids and molars examined, and on fewer than 50 percent of the other teeth. On cuspids, cementicles were found most frequently in the middle and apical thirds of the roots. On molars, cementicles were found most frequently in the furcations. A relationship was noted between the presence of enamel pearls in molar furcations and enamel projections from the cementoenamel junction. In the teeth with enamel projections, corresponding enamel pearls were found in 52 percent of maxillary molar furcations and in 64 percent of mandibular molar furcations. The findings suggest that cementicles occur in certain locations frequently enough to be of clinical importance.

No. 11
EFFECT OF BENDING SELF-THREADING PINS ON ENAMEL CRAZING

B. L. Keeney

The bending of pins after placement is a common practice in restorative dentistry. The purpose of this study was to determine whether the force produced by bending TMS Minim pins after placement causes crazing of the enamel surface. The crowns of 40 recently extracted human molars were sectioned 1.5 mm coronal to the cementoenamel junction and stained with a 50-percent aqueous solution of silver nitrate to detect existing cracks. None of the teeth were cracked. Minim pins were placed at the line angles of each tooth, 2 mm from the dentinoenamel junction toward the center of the tooth, for a total of 160 pins. Each tooth was stained with a 1-percent aqueous solution of methylene blue dye to detect crazing caused by pin placement. Staining revealed that 38 (24 percent) of the 160 pin sites showed crazing. At the remaining 122 sites, pins were bent to an angle of approximately 45°, and the teeth were stained with a 1-percent aqueous solution of phenol red dye to detect crazing caused by bending. Of the 122 sites, 25 (20 percent) showed crazing. According to our findings, bending Minim pins after placement increases the risk of enamel crazing; therefore, we recommend that these pins not be routinely bent.

No. 12
INTERNAL MEASUREMENT OF THE SETTING EXPANSION OF A PHOSPHATE-BONDED DENTAL INVESTMENT

E. T. Meiser

Strain gauges were invested in the center of a casting ring to determine the linear setting expansion (LSE) of dental casting investments at the site of the wax pattern. The strain gauge sensing axis was aligned parallel to the cylindrical axis of the casting ring. Gauge sensitivity was 1.0×10^{-6} inch/inch. A chromel-alumel thermocouple was invested 5 mm from the strain gauge, and temperatures were recorded throughout the setting process. Readings of the strain gauges were made continuously digitally as well as on an analog recorder. The investment evaluated was Complete (J. F. Jelenko Co.); six samples were made in 1.5-inch casting rings with a single layer of nonasbestos liner. The LSE value for Complete was 0.21 ± 0.14 percent for 1 hour setting time. After final set, the investment in the ring was loaded under compression to 750 psi (5.87 MPa). The strain gauge readings under repeated loads yielded a modulus E of 4×10^6 psi. This would indicate that the strain gauges follow the dimensional changes of the investment. The results are significantly different from those of the manufacturer, LSE = 1.5 ($\pm$0.1) percent, and those of Marsaw et al., LSE = 0.52 ($\pm$0.1) percent, which were obtained by different techniques. Only the current data and those of Marsaw et al. were obtained at the site of the wax pattern. This further indicates that measurements of external dimensional changes do not necessarily reflect the changes in dimension at the site of the wax pattern.

No. 13
CLINICAL AND HISTOLOGIC EVALUATION OF EXTRUDED ENDODONTICALLY TREATED TEETH IN MONKEYS

T. O. Mork

The purpose of this study was to determine the periodontal effects of relatively rapid orthodontic extrusion on endodontically treated teeth. The effect was studied in nine rhesus monkeys (Macaca mulatta). After removal of the clinical crown, nonsurgical endodontic therapy was performed on one mandibular central incisor in each monkey. A metal hook was cemented into the treated canal and a metal bar was affixed to the adjacent incisors so that it spanned the space created by the removal of the crown. The gingiva was tattooed to measure any coronal soft-tissue movement. An orthodontic elastic band was attached and the tooth was subjected to approximately 3 mm of extrusion in a period of 1 week or less. After extrusion, eight of the teeth were stabilized for weekly periods ranging from 1 to 8 weeks. The extruded teeth and surrounding periodontium, as well as a control tooth in each specimen, were examined histologically. The following histologic parameters were registered: character, orientation, and attachment of periodontal ligament fibers, position of the epithelial attachment, immature bone formation, and root resorption. At this time, specimens have been obtained from all nine monkeys and are undergoing decalcification in EDTA. When decalcified, they will be evaluated histologically.

No. 14
THE USE OF TOLUIDINE BLUE RINSE AS A SCREENING METHOD FOR EARLY DETECTION OF ORAL NEOPLASMS

G. N. Moyer

Early detection and prompt treatment of oral cancer are essential for increasing survival rates. Toluidine blue has been used since 1963 to detect carcinoma in situ and invasive carcinoma, but no one has used it as a diagnostic screening aid in a general dental population with normal-appearing oral tissues. The purpose of this study was to evaluate the use of toluidine blue as a screening procedure to identify areas of early neoplastic change that may be present in clinically normal-appearing oral tissues. The subjects elected for this investigation were patients requesting evaluation for routine dental care. If the oral tissues appeared normal, a toluidine blue rinse solution was used in a procedure that followed the technique developed by Mashberg. If any oral soft tissue stained positive, it was reevaluated within 10-14 days. The solution was applied directly to the area. If the same area stained positive again, a biopsy was performed and the tissue was submitted for histological diagnosis. Twenty-five patients (22 men and 3 women) have been screened to date. A positive tissue stain after the use of the oral rinse was detected in six patients (five men and one woman). A positive tissue stain after direct application occurred for one man. Microscopic examination of the tissue specimen revealed that the lesion was lichen planus. Although the toluidine blue solution was instrumental in the detection of an important lesion generally considered premalignant, an increased number of subjects will be investigated to validate the use of this dye material as a screening agent.

No. 15
A COMPARATIVE STUDY ON THE EFFECTIVENESS OF ROOT PLANING UNDER OPEN AND CLOSED CONDITIONS FOR REMOVING ENDOTOXIN, PLAQUE, AND CALCULUS

J. W. Rodden and W. B. Parker

Scaling and root planing is the cornerstone of periodontal therapy, but no microscopic or histochemical study has been reported on the effectiveness of surgical procedures for removing bacterial plaque, endotoxin, and calculus from periodontally diseased root surfaces. The intent of this study is to compare the effectiveness of root planing for the removal of bacterial plaque, calculus, and endotoxin with a simple flap procedure and root planing without the flap procedure. A total of 75-100 teeth requiring extraction for periodontal or prosthodontic reasons from healthy adult subjects will be randomly selected for treatment. Clinical parameters of recession, probing depth, and attachment level will be recorded on treated buccal, lingual, and proximal root surfaces. The level of the free gingival margin will be notched on accessible tooth surfaces before extraction to distinguish between supragingival and subgingival deposits. Teeth will then be blindly assigned for evaluation by either an endotoxin assay or stereomicroscopic examination. The limulus amebocyte lysate assay will be used to evaluate treated root surfaces for endotoxin. A stereomicroscope with an ocular grid will be used to evaluate stained root surfaces for residual calculus in accordance with the procedure outlined by Rabbani et al. The number of squares with residual calculus will be compared with the total number of squares covering the treated root surfaces. The effectiveness of root planing under surgical (open) and nonsurgical (closed) conditions will be ascertained by relating probing depths to results obtained from the endotoxin assay and the stereomicroscopic examination. Additional subjects and samples are being identified for the study. Final results will be reported at a later date.

No. 16
REST SEAT DESIGNS FOR INCLINED POSTERIOR ABUTMENTS: A PHOTOELASTIC COMPARISON

B. P. Sansom

Tilted removable partial denture abutments may complicate stress distribution in the surrounding periodontium. The more inclined these abutments are, the more difficult it may be to direct the transmitted forces along their long axes. The purpose of this study was to use photoelastic models to determine the optimum rest seat design for varying degrees of mesial tilt with posterior mandibular molar abutments in Kennedy Class III removable partial dentures. Forty-five photoelastic stress analyses were conducted with two-dimensional profile models that varied by the inclination of the distal abutment. Framework sections, cast in Ticonium, were configured with 15 different rest seat designs for each model, and stress tests were conducted by applying 120-lb loads to the midpoint of each framework. The results indicate that inclined abutments demonstrate greater resultant torque than vertical abutments, and the greater the inclination, the greater the torque or tipping force. Mesial rests on inclined molar abutments result in maximum torque, and channel rests on inclined molar abutments result in the least amount of torque.

No. 17
AN EVALUATION OF OVERHANG REMOVAL METHODS: AN SEM STUDY

G. C. Spinks

The sonic scaler, the curet, and the reciprocating motor-driven diamond tip were compared for root surface roughness and gaps resulting from recontouring overhanging restoration margins. Ninety extracted human teeth were restored so that amalgam and light-cured resin overhangs were created. Each of the three types of instruments was used to remove 30 overhangs. The root surfaces apical to the overhangs were photographed under the electron microscope at a magnification of 140X and compared by five dentists, in a single-blind manner, with two control photomicrographs determined to be rough (treated with a diamond bur) or not rough (treated with a greenstone). Statistical comparisons of the number of rough responses for each of the instruments were made by chi-square analysis. The smoothest surface was produced by the curet. The sonic scaler produced a distinctly rougher root surface than either of the other two instruments. No apparent difference in the production of gaps between restoration and tooth was noted among the instruments. Clinical ease of overhang removal was greatest for the reciprocating motor-driven diamond tip and least for the curet. The average time to remove the overhang from a tooth was 3 minutes for the motor-driven diamond tip, 7 minutes for the sonic scaler, and 15 minutes for the curet.

No. 18
PARTICIPATION OF MYOFIBROBLASTS IN THE STROMAL RESPONSE TO HUMAN ORAL CARCINOMA

J. C. Whitt

Contractile fibroblasts (myofibroblasts), which share some of the ultrastructural and pharmacologic characteristics of smooth muscle cells, have been found in the stroma subjacent to extraoral epithelial malignant neoplasms. This myofibroblastic proliferation may effect some form of containment of the tumor cells by limiting their mobility and thus may be of survival value to the host. No studies have been reported on the possible role of a myofibroblastic proliferation in response to oral epithelial malignant neoplasms; therefore, the purpose of this study was to evaluate oral carcinomas for the presence of myofibroblasts. The number of myofibroblasts present in the stroma of carcinomas of the lip, tongue, and floor of the mouth was determined according to ultrastructural criteria. A proliferation of myofibroblasts in the stroma subjacent to carcinoma of the lip may explain the relatively low incidence of metastasis and more favorable prognosis of lip carcinoma than of carcinoma of the tongue and floor of the mouth. To date, tissue from three carcinomas of the floor of the mouth and one lip carcinoma has been processed for examination by light and electron microscopy. Findings by light microscopy show that invasive squamous cell carcinoma elicits varying host responses, ranging from a loose edematous stroma to a highly collagenous fibrous stroma. Ultrastructural examination of the markedly fibrous stroma of one carcinoma of the floor of the mouth showed the presence of myofibroblasts. No myofibroblasts were noted in control tissue. This finding suggests that myofibroblasts play a role in containment of the neoplasm, but the study is continuing in an effort to include a larger number of cases to complete the ultrastructural examination.

ABSTRACTS OF SECOND-YEAR REPORTS

No. 1
THE CASTABILITY OF VARIOUS BASE METAL ALLOYS UTILIZING THE GAS-OXYGEN HAND TORCH TECHNIQUE

R. A. Brunhofer and M. P. Larson

High temperatures are required for casting base metal alloys. The gas-oxygen torch offers a readily available, inexpensive method of achieving this goal, but few studies have been reported on its use in casting base metal alloys. The purpose of this study was to evaluate the castability of base metal alloys when the gas-oxygen hand torch was used. Five popular base metal alloys (Rexillium III, Co-Span, Unibond, Ceramalloy II, Heydium) and a Type III gold alloy (control) were evaluated. Castability was determined by using the test pattern technique of Whitlock et al. The test pattern was a No. 18 polyester sieve cloth with a grid containing 100 open squares and 200 segments. Test patterns were cast with five samples of each alloy. The number of complete cast segments in each test pattern was counted, and a percent castability value was calculated. The castability values were 100 percent for the control, Rexillium III, and Co-Span; 92 percent for Unibond; 88 percent for Ceramalloy II; and 37 percent for Heydium. In terms of castability, only Ceramalloy II and Heydium differed significantly from the control ($P < .01$ by Student t test).

No. 2
ROOT CANAL TEMPERATURE DURING OBTURATION WITH THE McSPADDEN COMPACTOR TECHNIQUE

W. J. Dollard

The McSpadden compactor technique is a relatively quick, efficient means of obturating root canals, but the heat produced by the compactor might damage the periodontal ligament and cause volumetric changes in gutta-percha. No studies have been reported to document the temperature produced in the root canal by the compactor. The purpose of this study was to measure the amount of heat produced during thermatic condensation of gutta-percha with the McSpadden compactor. Eight previously extracted single-rooted human teeth were used. Each tooth was prepared for obturation and then split in half longitudinally. Horizontal grooves were made in the canal wall at levels of 2, 4, 6, and 8 mm from the apex of the tooth. Thermocouples were placed in the grooves flush with the canal wall, and the halves of the tooth were cemented together. The thermocouples were attached to a continuous-strip recorder to measure the temperature at each level. Four teeth were obturated with the McSpadden technique, and as a control, four teeth were obturated with the conventional warm gutta-percha technique. The mean temperatures produced in the canals during obturation with the McSpadden technique ranged from $45.7° \pm 3.6°$ C at the 2-mm level to $72.6° \pm 9.2°$ C at the 8-mm level. There were no significant differences ($P > .01$ by Student t test) between the mean canal temperatures produced by the McSpadden and the control obturation techniques at any levels.

No. 3
HEMODYNAMIC AND SYMPATHETIC RESPONSE TO LOCAL ANESTHETIC CONTAINING EPINEPHRINE

C. D. Ferguson

Although much has been written about the potential hazards of using local anesthetics containing epinephrine, there is still a great deal of confusion about the actual effect of such anesthetics on hemodynamics and the sympathetic nervous system. The purpose of this clinical study was to evaluate the effect on mean arterial pressure (MAP), heart rate (HR), and plasma epinephrine (E) and norepinephrine (NE) of mandibular block anesthesia produced by lidocaine anesthetic solutions with and without epinephrine. Ten healthy men, with a mean age of 35 years, were evaluated in a randomized double-blind crossover manner. MAP and HR were measured and blood samples were collected 20 and 30 minutes before the anesthetic was administered and 1, 2, 4, 8, 16, 30, and 60 minutes after administration. Anesthesia was achieved with a 1.8-ml cartridge containing either lidocaine 2 percent or lidocaine 2 percent with 1:100,000 epinephrine. Lidocaine alone caused no significant changes ($P > .05$) from the baseline values in MAP, HR, or plasma E and NE at any time, whereas lidocaine with epinephrine caused a significant increase ($P < .05$) in plasma E at each of the time intervals up to 60 minutes after injection, and a significant increase ($P < .05$) in HR for only the first 2 minutes after injection. Lidocaine with epinephrine caused no change in MAP or plasma NE. These results show that lidocaine with epinephrine causes an increase in plasma E, but the hemodynamic response is minimal in healthy persons.

No. 4
THE EFFECTS OF CLASS V CAVOSURFACE DESIGNS ON MICROLEAKAGE APICAL TO THE CEMENTOENAMEL JUNCTION USING A DENTINAL BONDING AGENT

K. F. Gillette and B. E. Robinson

The failure of Class V composite restorations due to microleakage has been a constant concern to the practitioner. Severe leakage has been reported at the gingival margin, especially when the restorations are placed on dentin or cementum. With the recent interest in dentin-bonding agents, several new bonding systems with the primary function of bonding composite resins to dentin have been introduced to dentistry. The purpose of this study was to evaluate microleakage of various margin designs located apical to the cementoenamel junction (CEJ) in preparations treated with a dentin-bonding agent (Scotch Bond) and restored with a visible-light-cured microfilled resin (Silux). Ninety Class V preparations were placed in 45 teeth. Half of each preparation was placed apical to the CEJ and half coronal. Preparations were divided into three groups of 30 each according to margin design: butt joint (control), long bevel, and curved bevel. Preparations were treated with the bonding agent, and restorations were placed according to the manufacturer's recommendations. The teeth were thermocycled 500 times between 5° C and 55° C, then stained with silver nitrate, sectioned, and graded for microleakage. No significant difference was observed in microleakage characteristics among butt joint, curved bevel, and long bevel cavosurface margins placed below the CEJ ($P > .01$ by chi-square analysis).

No. 5
A STUDY ON THE SOFTENING OF GUTTA-PERCHA IN CHLOROFORM AND EUCALYPTOL

M. D. Hickey

Eucalyptol has been suggested as a possible replacement for chloroform to soften gutta-percha cones. At room temperature, however, eucalyptol takes considerably longer than chloroform to soften gutta-percha cones. The use of eucalyptol would be clinically practical only if its softening properties could be increased. The purpose of this study was to compare the effect of heat on the softening properties of eucalyptol and chloroform. Thirty No. 50 gutta-percha cones were tested. Each cone was held with endodontic locking forceps and the tip of the cone was lowered about 15 mm into the test solution. Softening time was determined as the time from immersion of the cone until the tip of the cone completely separated from the main body. Five cones were immersed in chloroform and five in eucalyptol at temperatures of 22° C, 37° C, and 50° C. The softening properties of both agents generally increased as the immersion temperature increased. For cones immersed in chloroform, the softening time was 1 min 28 sec at 22° C, 1 min 16 sec at 37° C, and 59 sec at 50° C. For cones immersed in eucalyptol, the softening time was 20 min 46 sec at 37° C and 10 min 11 sec at 50° C. The tips of cones immersed in eucalyptol at 22° C had not softened sufficiently to separate from the bodies at 60 min. These results show that heating eucalyptol above room temperature increases its softening properties, although it still takes considerably longer to soften gutta-percha cones with eucalyptol than with chloroform. Despite these longer softening times, eucalyptol must be considered as a likely alternative to chloroform if chloroform is proven to be a carcinogen in man.

No. 6
CLINICAL EVALUATION OF IRRADIATED FREEZE-DRIED SKIN ALLOGRAFTS IN HUMANS

H. T. Hickson

The routine use of freeze-dried skin (FDS) allografts is limited because of possible allergic responses to antibiotics that may remain in the tissue after sterilization. Irradiated freeze-dried skin (IFDS) has been proposed as a remedy for this problem, but there are few studies on the clinical efficacy of IFDS allografts. The purpose of this study was to compare FDS and IFDS allografts in humans for shrinkage, graft acceptance, mobility, esthetics, and postoperative discomfort. Ten subjects received 9 FDS and 12 IFDS allografts. Seven of these subjects received paired FDS and IFDS allografts. Data were collected before, immediately after, and 1, 2, 4, 12, and 24 weeks after the procedure. At 24 weeks, all 21 allografts were present. There was a mean shrinkage of 58 percent for FDS and 62 percent for IFDS allografts, not a significant difference ($P \geq .05$ by Student t test). Five FDS and five IFDS allografts were mobile; four FDS and two IFDS allografts were esthetic. Subjects with paired allografts reported mild-to-moderate postoperative discomfort at both sites. When data for graft acceptance, mobility, esthetics, and postoperative discomfort were compared, there was no significant difference ($P \geq .05$ by chi-square analysis) between FDS and IFDS allografts. Our results suggest that IFDS can be substituted for FDS with no difference in clinical results.

No. 7
THE EFFECTS OF POSTERIOR INTERPROXIMAL CONTACTS ON PERIODONTIUM

J. L. Hilgeman

Studies relating contact integrity and periodontal status are conflicting. Few reports address the integrity of the interproximal contact and its associated periodontal condition. Of the studies that have been done, a number are limited to a relatively youthful population. The purpose of this study was to investigate interproximal contact strength and its associated periodontal condition in an older population. Subjects were selected from patients and staff at the Naval Hospital and the Naval Dental Clinic, Bethesda, Maryland. Those selected were divided into two groups: 30-40 years and 50 years or older. Examinations of the posterior interproximal areas were conducted to determine gingival inflammation, probing depth, loss of attachment, presence of calculus, food impaction, restorations and overhangs, carious lesions, plaque indexes, and contact integrity. One examiner performed all the evaluations. The examiner was trained in evaluation procedures so that there was a 90-percent or better agreement with another periodontist. In the 50 participants aged 30-40 there was more food impaction with loose contacts than with open or tight contacts. An increased loss of attachment was associated with overhangs and interproximal restorations. In the 49 subjects over 50 years old an increased loss of attachment was associated only with interproximal restorations. No significant difference in attachment loss was linked to type of contact or food impaction in either group ($P > .01$ by Student t and chi-square analyses).

No. 8
PULPAL RESPONSE TO REPEATED ELECTRICAL PULP TESTING

J. H. Isaacson

In difficult diagnostic cases, teeth may be pulp tested several times within a relatively short period. The procedure may change the pain threshold so that a true response is not actually determined. A study was undertaken to examine this response to repeated electrical pulp testing. Twenty subjects with bilateral nonrestored maxillary cuspids were selected. All the test teeth were air-dried, isolated with cotton rolls, and pulp tested with a digital pulp tester (Model 2001, Analytic Technology). Thirty right or left maxillary cuspids were tested in alternate subjects, with the contralateral tooth serving as the control. Each tooth in the experimental group was pulp tested five times, with a 1-minute interval between tests. The control teeth were tested twice, before and after the experimental teeth, with approximately an 8-minute interval between tests. Mean threshold values were calculated for each interval and statistically evaluated with the Student t test. Results showed no significant changes ($P > .05$) in pulpal response thresholds in either the experimental or control groups. Under the conditions of this study, repeated electrical pulp testing did not significantly alter pulpal response thresholds in maxillary cuspids of human subjects.

No. 9
AN EVALUATION OF MICROLEAKAGE IN A DENTIN-BONDING SYSTEM

R. F. Kuhel

The failure of many Class V composite restorations is due to leakage at the gingival margin. New products that claim superior dentinal bonding characteristics are frequently introduced. The purpose of this study was to evaluate a dentin-bonding and restorative system (Den-Mat) for marginal leakage in extracted human teeth. Class V cavity preparations were cut so that the gingival margin was located on the root surface. Sixty preparations in the experimental group were etched with citric acid, and then a drying agent and a dentin-bonding agent were applied. Forty-eight preparations in the control group were treated in the same manner, except that the dentin-bonding agent was omitted. All preparations were coated with a diluent resin and restored with the recommended composite material. Three groups of experimental and control restorations were stored in 37° C water for 24 hours, 3 weeks, or 6 weeks and then thermocycled for 4,000 cycles. All the restorations were stained with silver nitrate, sectioned, and graded for leakage. In restorations placed with the dentin-bonding agent, 95 percent showed staining on the pulpal wall, 2 percent showed staining along the gingival wall, and only 3 percent had no staining. There was no significant difference in leakage between restorations placed with the dentin-bonding agent and those placed without the agent ($P > .05$ by chi-square analysis). It does not appear that this dentin-bonding and restorative system reduces marginal leakage.

No. 10
THE EFFECT OF A 0.2-PERCENT SnF_2 MOUTHRINSE ON GINGIVAL TISSUES AND ASSOCIATED MICROFLORA

L. Larson

A 5-month double-blind crossover clinical study was conducted to evaluate the effects of a commercially available 0.2-percent SnF_2 mouthrinse. Twenty-four young adults (mean age 25 years) participated. Six sites with a Gingival Index (GI) of 2 or 3 were evaluated in each subject. There were two experimental 2-month periods during which the subjects rinsed daily with a mouthrinse and a 1-month interim period of no rinsing. During the first experimental period half the subjects used the SnF_2 mouthrinse and half used a nonfluoridated mouthrinse. This rinsing schedule was reversed during the second experimental period. All subjects performed their usual oral hygiene procedures. Data were collected from each gingival site for bleeding tendency after plaque collection, the GI, and phase-contrast microscopic assessment of bacterial motility. Plaque samples were collected by passing a round wooden toothpick no deeper than 2 mm subgingivally at each site. Evaluation of the results demonstrated a significant decrease in bleeding tendency with the daily use of the 0.2-percent SnF_2 mouthrinse ($P < .01$ by chi-square analysis). No significant difference was noted for the GI or the bacterial motility ($P > .05$). There appears to be a limited beneficial effect with the daily use of a 0.2-percent SnF_2 mouthrinse.

No. 11
INTERNAL VOLUMETRIC SETTING EXPANSION OF CASTING INVESTMENTS

F. A. Marsaw

Previous studies of setting expansion employed external measurements on a core of investment material; no determinations have been attempted in the center of the mold where the wax pattern is located. The purpose of this study was to develop a technique for evaluating setting expansion in the pattern area of an investment mold. The setting expansion of three commercially available phosphate-bonded investments was determined by measuring the change in volume of a cavity located in the center of the investment. A water-filled reservoir with a volume of 1.2 ml was connected to a 0.1-ml pipette (0.3 mm in diameter) and embedded in the center of the casting investment. Changes in the volume of the reservoir produced changes in the water level in the pipette. The internal temperature of the investment was monitored by a thermocouple. This experiment was performed with both nonyielding metal and yielding rubber casting rings. Volumetric measurements for each of the three investments tested yielded mean linear setting expansions (LSE) of 0.57±0.08 percent (n=14), 0.56±0.10 percent (n=13), and 0.39±0.08 percent (n=10). The LSE of the investments was also determined according to the trough method of ADA specification No. 2; these measurements were 0.75±0.22 percent (n=5), 0.64±0.50 percent (n=5), and 0.86±0.63 percent (n=5). Internally determined LSE values showed less variability than externally determined LSE values. The differences between the results for the metal and rubber casting rings were indistinguishable. These findings indicate a need to reevaluate the methods by which setting expansion is measured as well as the mechanism by which this expansion takes place.

No. 12
ENDOTOXIN RECONTAMINATION FOLLOWING ROOT PLANING IN VIVO

F. Martinez, Jr.

Endotoxin is a biologically active substance with periodontopathic potential. Although root surfaces exposed to periodontal disease have been shown to contain cementum-bound endotoxin, vigorous root-planing procedures are usually effective in removing most of the endotoxin. However, the rate of recontamination of previously scaled root surfaces with endotoxin has never been reported. The purpose of this study was to quantify endotoxin recontamination with the limulus amebocyte lysate test. The study was designed to include three post-treatment groups of 0, 10, and 30 days, with 25 teeth pooled for each group. The pooled endotoxin samples obtained from each group were analyzed for endotoxin content according to the procedures outlined by Nishimine and O'Leary. There was a progressive increase in the amount of endotoxin found in samples from previously treated proximal root surfaces, from 6.5 ng to 70.0 ng at 30 days. The findings indicate that endotoxin recontamination begins early, that it parallels the microbial and soft-tissue changes reported by others, and that there is a progressive increase in endotoxin contamination with time.

No. 13
CALIBRATION RELIABILITY OF THE CAULK VARI-MIX II AMALGAMATOR

R. W. McCall

Because variation in trituration speeds of an amalgamator can have a pronounced effect on the final restoration, dentists cannot afford to take it for granted that the trituration speed of a particular amalgamator remains constant during use. The purpose of this study was to determine the calibration reliability of the Vari-Mix II amalgamator (L. D. Caulk) at different times of use. Twenty used and 10 new amalgamators were initially calibrated to 3,600 cpm as recommended by the manufacturer. An activation period of 10 seconds was used, and the amalgamators were recalibrated with a strobe light timer after each period of 75 activations, for a total of 600 activations per machine. An overall increase in oscillation frequency was noted for both the new and used amalgamators, but the frequency of the new machines increased significantly more rapidly after 150 activations than the frequency of the used ones ($P < .01$ by Student t test). The new amalgamators exceeded the manufacturer's limits after 180 activations, and the used ones after 375 activations. The findings suggest that new and used amalgamators be recalibrated accordingly.

No. 14
THE EFFECT OF TAPERING ON WROUGHT WIRE FLEXIBILITY

E. A. Monaco

The historic advantages of the wrought wire clasp are its flexibility, adjustability, and appearance. Tapering has been recommended as a method of improving clasp flexibility, stress distribution, and contour. Two types of taper have been recommended: a partial taper involving taper of the outside surface of the terminal segment of the retainer arm, and a full taper involving uniform taper of the entire retainer arm contacting the abutment. In this study, the partial and full taper were evaluated on 18-gauge and 19-gauge Ticonium wrought wire (base metal), Hey P.G.P. wrought wire, and Jelenko Super Wire. Untapered 18-, 19-, and 20-gauge wrought wire served as the control. The amount of taper used was based on clinical judgment and flexibility values in the literature. The tapering was accomplished manually by a bench lathe with a mounted-faced 100-grit vitrified aluminum oxide wheel. Wrought wire samples were lightly polished, measured, and adapted to a Plexiglas cylindrical die 10 mm in diameter. The samples were tested on an Instron Universal testing machine. The loading rate was 0.1 inch per minute. Flexibility was computed from values determined from the deflection curves and was compared within each alloy subgroup by the Student t test at the probability level $P < .05$ for significance. The partial-taper wrought wire flexibility was not significantly different from that of the untapered wrought wire. Full taper significantly increased flexibility. A fully tapered 18-gauge wrought wire displayed flexibility similar to that of an untapered 20-gauge wrought wire. Full-taper wrought wire produced atypical multiphase load deflection patterns, indicating that stress distribution was not uniform along the tapered retainer arm. The results of this study indicate that the use of a full-taper 18-gauge wrought wire allows greater strength at the point of attachment than would be provided by a smaller wire, acceptable stress distribution along the length of the retainer arm, and flexibility comparable to that of a smaller 20-gauge untapered wire.

No. 15
MUSCLE STRENGTH RELATED TO THE USE OF INTEROCCLUSAL SPLINTS

M. W. Parker

The use of interocclusal acrylic splints is purported to improve muscle strength and athletic performance, but the evidence supporting such claims is primarily anecdotal and subjective. This study was undertaken to assess the effect of two interocclusal splints on the strength of the arm adductor muscles and the quadriceps muscles in 10 subjects having no signs, symptoms, or history of myofascial pain dysfunction syndrome, temporomandibular joint dysfunction, or posterior bite collapse. An isokinetic dynamometer was used to measure the strength of a subject's arm adductor muscles over a range of jaw positions. The position associated with the greatest strength was recorded as the optimum jaw position, and a rigid flat plane mandibular splint was fabricated and equilibrated at the optimum position. A resilient vinyl mandibular splint with an arbitrary thickness and a placebo splint that permitted unrestricted closure to centric occlusion also were made for each subject. The strength of a subject's arm adductor and quadriceps muscles with each of the three splints was measured on the dynamometer and the measurements compared with baseline values obtained with the subject in centric occlusion to determine changes in strength. Comparisons between mean strength changes with the placebo and the other two splints showed no significant differences ($P > .05$) on the basis of parametric and nonparametric analyses. Within the scope of this study, use of interocclusal splints had no effect on muscle strength.

No. 16
A STUDY OF ARBITRARY MANDIBULAR HINGE AXIS LOCATIONS

J. W. Simpson

The relative ease and quickness of using the arbitrary method of locating the mandibular hinge axis have led to its ready acceptance. However, studies comparing the various arbitrary hinge axis points to the kinematically located hinge axis show considerable variation as to the arbitrary point that most closely and consistently approximates the kinematic axis. The purpose of this study was to quantitatively compare arbitrary hinge axis locations described by Beyron, Gysi, Bergstrom, and Teteruck and Lundeen, as well as a point selected by the author, with the kinematically located axis. Fifty human subjects with functionally acceptable occlusions and no clinical signs of TMJ disorder were evaluated. Measurements for the five arbitrary points were made with an Almore mandibular hinge axis locator in conjunction with the eyeglass-type flag holders from the TMJ articulator assembly. The kinematic hinge axis was located according to the method suggested by Lauritzen and Bodner. Analysis of the results indicates a significant difference between the experimental arbitrary point and the other arbitrary points in relation to the number of points falling within 5 mm of the kinematic axis and in relation to the distance of all points away from the kinematic axis ($P < .01$ by chi-square analysis and Student t test). The results of this study indicate that the experimental arbitrary point more closely and consistently approximates the location of the kinematic axis than do the arbitrary points of Beyron, Gysi, or Bergstrom.

No. 17
A COMPARISON OF SONIC AND HAND INSTRUMENTATION USING HISTOLOGY AND SCANNING ELECTRON MICROSCOPY

K. H. Vance

The purpose of this study was to compare morphologically, by scanning electron microscopy, the root surfaces of periodontally diseased human teeth instrumented with hand curets and those instrumented with a sonic scaler instrument; comparisons were also made histologically on the contiguous soft tissues. Two groups of teeth were instrumented circumferentially to the bottom of the clinical pocket with either sharp Gracey hand curets or a sonic scaler instrument. The teeth were then extracted, and gingival biopsies were made. The teeth were prepared for critical-point drying with CO_2 and coated with gold by an evaporation technique. The biopsy specimens were prepared for histologic evaluation and stained with either hematoxylin and eosin or Mallory's trichrome. Histologic evaluation of 21 specimens revealed that remnants of crevicular epithelium remained in 3 of 10 specimens instrumented with hand curets and in 4 of 11 specimens instrumented with the sonic scaler. No foreign bodies were implanted in any of the specimens. Scanning electron microscopy revealed that none of the specimens examined were totally free of accretions remaining on the root surface. Alterations to the root surface were observed in 7 of 10 specimens instrumented with hand curets and in 6 of 12 specimens instrumented with the sonic scaler. None of these differences were significant ($P > .05$ by chi-square analysis). Analysis of the data suggests that instrumentation with the sonic scaler is similar to hand instrumentation in the removal of accretions and in the alteration of the root surface.

No. 18
A COMPARISON OF VENTING AND DIE-RELIEF TECHNIQUES ON THE RETENTION OF COMPLETE POSTERIOR CROWNS

J. S. Yorty

Improved marginal seal and retention can be obtained by proper seating of full-coverage dental castings on cementation. Two of the most popular methods for achieving this goal are to provide a vent in the casting for escape of cement or to provide internal relief for cement by using a die spacer material. To date, no study has been reported that directly compares the retention of vented castings with the retention of die-relieved castings on cementation. The purpose of this study was to examine the retention provided by each method. Twelve extracted human molars were prepared for full-coverage castings and embedded in acrylic resin blocks. An impression was made, three dies were poured, and three crowns were cast for each sample tooth. The first casting was vented, the second was die-relieved, and the third was neither vented nor die relieved (control). Each casting was examined with a measuring microscope for accuracy of marginal fit. A casting was randomly selected for cementation on its sample tooth and removed after 24 hours. The force necessary to unseat this casting was determined with a Chatillon compression testing machine. The two other castings were similarly tested. The results showed that die-relieved and vented castings provide the same retention on cementation and that both techniques provide significantly better ($P < .005$ for the die-relieved castings and $< .01$ for the vented castings by paired "t" statistical analysis) retention than do unrelieved, unvented castings.